

# Interdependence: cellular respiration and pic

[Science](#), [Biology](#)



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INTERDEPENDENCE IN NATURE Many of the relationships between organisms in nature are those of dependence. Whether it be a deer breathing oxygen produced by a nearby tree or a tick sucking the blood of its unsuspecting host, every organism depends on another organism in some way. [pic]

Molecules and Cells • Photosynthesis and Cellular Respiration

[pic]Photosynthesis is the process by which autotrophs convert solar energy into the chemical bond energy of glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>).  
$$\text{CO}_2 + 12\text{H}_2\text{O} + \text{solar energy} \longrightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} + 6\text{O}_2$$
  
[pic]Cellular respiration is the process by which autotrophs and heterotrophs convert the chemical bond energy of glucose into the usable bond energy of ATP. Aerobic Cellular Respiration  
$$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \longrightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + 38 \text{ ATP}$$
  
Anaerobic Cellular Respiration  
$$\text{C}_6\text{H}_{12}\text{O}_6 \longrightarrow 2 \text{ EtOH} + 2\text{CO}_2 + 2 \text{ ATP (Alcoholic Fermentation)}$$
  
$$\text{C}_6\text{H}_{12}\text{O}_6 \longrightarrow 2 \text{ Lactic Acid} + 2 \text{ ATP (Lactic Acid Fermentation)}$$
  
The oxygen by-product of photosynthesis is used in aerobic cellular respiration by all aerobic organisms.

Carbon dioxide (CO<sub>2</sub>) is released following aerobic cellular respiration and alcoholic fermentation (one form of anaerobic cellular respiration) and is then used by autotrophs during photosynthesis. Thus, these are reciprocal processes. Glucose is produced by autotrophs during photosynthesis. Both autotrophs and heterotrophs break down the glucose to form ATP during cellular respiration. Energy, therefore, is transferred between the autotrophic and heterotrophic levels. Autotrophs are dependent upon heterotrophs only for CO<sub>2</sub>.

All heterotrophs are dependent, either directly or indirectly, on autotrophs for energy, but only aerobic heterotrophs are dependent on autotrophs for

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oxygen (O<sub>2</sub>. ) [pic] • Enzymes and Substrates [pic]The rate at which a reaction occurs is dependent upon the concentration and/or volume of enzymes and the concentration and/or volume of substrates. • Water [pic]Every organism in nature is dependent on water for survival because all chemical reactions take place in water. [pic] Heredity and Evolution • Sporophyte and Gametophyte Generations [pic]In mosses, the sporophyte grows directly out of and becomes nutritionally dependent on the gametophyte. • Flowers and Their Pollinators [pic]Flowers depend upon pollinators for the success of their reproductive cycles and insects depend upon flowers for nectar. • Phenotypes [pic]The characteristics of an organism are determined both by the combination of its genes as well as the organism's environment. (multifactorial inheritance) [pic] Organisms and Populations • Symbiotic Relationships [pic]Symbiosis is any relationship between individuals of two different species.

There are several types of symbiotic relationships: ? Cooperation - both individuals benefit, but are independent of each other ex: oxtail birds and gnu The gnu is covered with tiny parasites that provide the bird with food and in return, the oxtail bird keeps the gnu free of parasites. ? Mutualism - both individuals benefit and are dependent upon one another ex: lichen = alga and fungus The alga performs photosynthesis and the fungus absorbs water and minerals as well as provides anchorage. Commensalism - one individual benefits and the other is unaffected ex: barnacles attach themselves to marine mammals such as manatees and whales [pic][pic] The marine mammals provide a moving substrate on which the barnacles may attach while the mammals remain unaffected. ? Amensalism - one individual

is harmed and the other is unaffected ex: Spanish moss Spanish moss grows on trees and chokes out virtually all light going to the tree.

While the Spanish moss remains unaffected, the tree does not receive enough light to perform an adequate amount of photosynthesis to survive. ?

Competition - both individuals are harmed ex: rabbit and a mouse [pic][pic]

The rabbit and the mouse compete for the same herbaceous plants. ?

Predation - one individual benefits and the other is harmed ex: coyotes

preying on rabbits ? Parasitism - one individual benefits and the other is

harmed ex: a leech sucking the blood of its human host •Pollution[pic]With

the increasing industrialization of the world, comes much pollution. Fossil fuel burning has released tremendous amounts of CO<sub>2</sub> into the atmosphere.

This excess of CO<sub>2</sub> in the atmosphere traps solar energy in the form of heat.

This effect is called the Greenhouse Effect. In addition, deforestation of the

tropical rainforests has decreased the sink for CO<sub>2</sub>, thus augmenting the

situation. The subsequent increase in atmospheric temperature is known

as global warming. [pic]Sulfur and nitrogen oxides are produced almost

exclusively by human activities.

The combination of these compounds with water vapor in the air, creates

acid. Acid rain has far-reaching effects on all aspects of life. Not only does

acid rain severely damage the leaves of plants, but it also changes the pH of

bodies of water. Such drastic changes gravely affect life. [pic] [pic] [pic][pic]

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